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CHARACTERIZATION OF TRANSDERMAL DRUG DELIVERY SYSTEM USING VISIBLE SPECTROPHOTOMETRY AND ARTIFICIAL NEURAL NETWORK

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as references. This topic has not been submitted to other academic institution or non-academic institution for attainment for any other degree or qualification.

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ABSTRACT

This thesis presents the study and development of non-destructive visible spectrophotometry technique and artificial neural network (ANN) to characterize the drug content of solid polymeric films for use as transdermal drug delivery system (TDDS). Hydroxypropylmethylcellulose (HPMC) and nifedipine was selected as model matrix polymer and drug respectively. Both blank and drug loaded HPMC films were prepared by solvent evaporation method. These films were conditioned at the relative humidity of 25, 50 and 75% prior to physicochemical characterization using the established methods of ultraviolet spectrophotometry, differential scanning calorimetry and fourier transform infrared spectroscopy methods, as well as, self-assembled non-destructive visible spectrophotometry technique. The absorption intensity for visible wave of films with a low drug load was largely higher in samples stored at 25 and 75 % relative humidity, whereas it was generally higher in samples kept at higher level of relative humidity when moderate drug loads were added to films. In the case of films carrying a high drug load, mixed visible wave absorption characteristics were noted depending on wavelength of visible wave absorbed by matrix and storage relative humidity. In response to the influence of relative humidity, the variation in absorption intensity of drug loaded films for visible wave was ascribed to the changes in the physicochemical ambience of drug with the surrounding polymeric environment involving =C-N-H and/or O-H, aromatic =C-H and/or C-H, as well as, aromatic –C=C, cyclic –C=C and/or C=O moieties. In spite of changing relative humidity of the storage condition, a significantly high level of correlation between drug load and visible wave absorption intensity was attainable by these films (Pearson correlation: $r \geq 0.90$, $p < 0.01$). The results indicated that the visible spectrophotometry technique is suitable for use to characterize the drug content of solid polymeric films without the introduction of solvation or reaction process. ANN was used to predict the drug content of solid polymeric films. The ANN training was done by using a Multilayer feed forward neural network (MFNN) with Quasi-Newton learning algorithm. Selected absorbance spectra produced by visible spectrophotometry technique were utilized as inputs to the ANN model and the drug contents value as an output. The tangent sigmoidal (tansig) function was used for the ANN activation and mean square error (MSE) of the network prediction is used as the cost function during each iteration of the training process. The results show that ANN is accurate in predicting the drug content with average prediction accuracy of 98.06%, respectively. In conclusion, visible spectrophotometry and ANN have been shown to be a promising tool in providing non-destructive determination of drug content of solid polymeric films.

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CHAPTER 3: THEORY